

Sandia  
National  
Laboratories

# LABS

## ACCOMPLISHMENTS

*Exceptional service in the national interest*





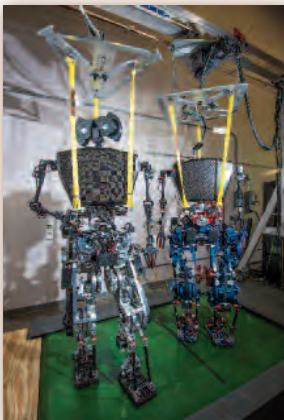
SANDIA NATIONAL LABORATORIES, with principal locations in Albuquerque, New Mexico (above), and Livermore, California (right), grew out of America’s World War II effort to develop the first atomic bombs. Today, keeping the US nuclear stockpile safe, secure, and effective is a major part of Sandia’s work as a multidisciplinary national security engineering laboratory. Sandia’s science, technology, and engineering foundations enable its unique mission. The Labs’ highly specialized research staff is at the forefront of innovation, collaborating with universities and companies and performing multidisciplinary science and engineering research programs with significant impact on US security.

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This year’s *Labs Accomplishments* highlights some of Sandia’s best work during 2016, as submitted by the Labs’ Center offices and selected by Division offices. Readers will see numbers in parentheses following many of the entries that indicate the Centers (as of FY16) where the bulk of the work was performed for those accomplishments.



Front cover

Through a project supported by DoD’s Defense Advanced Research Projects Agency (DARPA), Sandia is developing technology to dramatically improve the endurance of legged robots, such as the Labs’ WANDERER and STEPPR robots seen here, helping them operate for long periods while performing the types of locomotion most relevant to disaster response scenarios.



Back cover

Sandia’s Thor accelerator is designed to study materials at extreme pressures; its novel features may foreshadow future renovations in Z, the world’s largest and most powerful pulsed-power accelerator. In the photo, Sandian Eric Breden terminates a transmission cable for installation on the silver disk that is the new machine’s central powerflow assembly.

Cover photographs by Randy Montoya

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SandiaLabNews

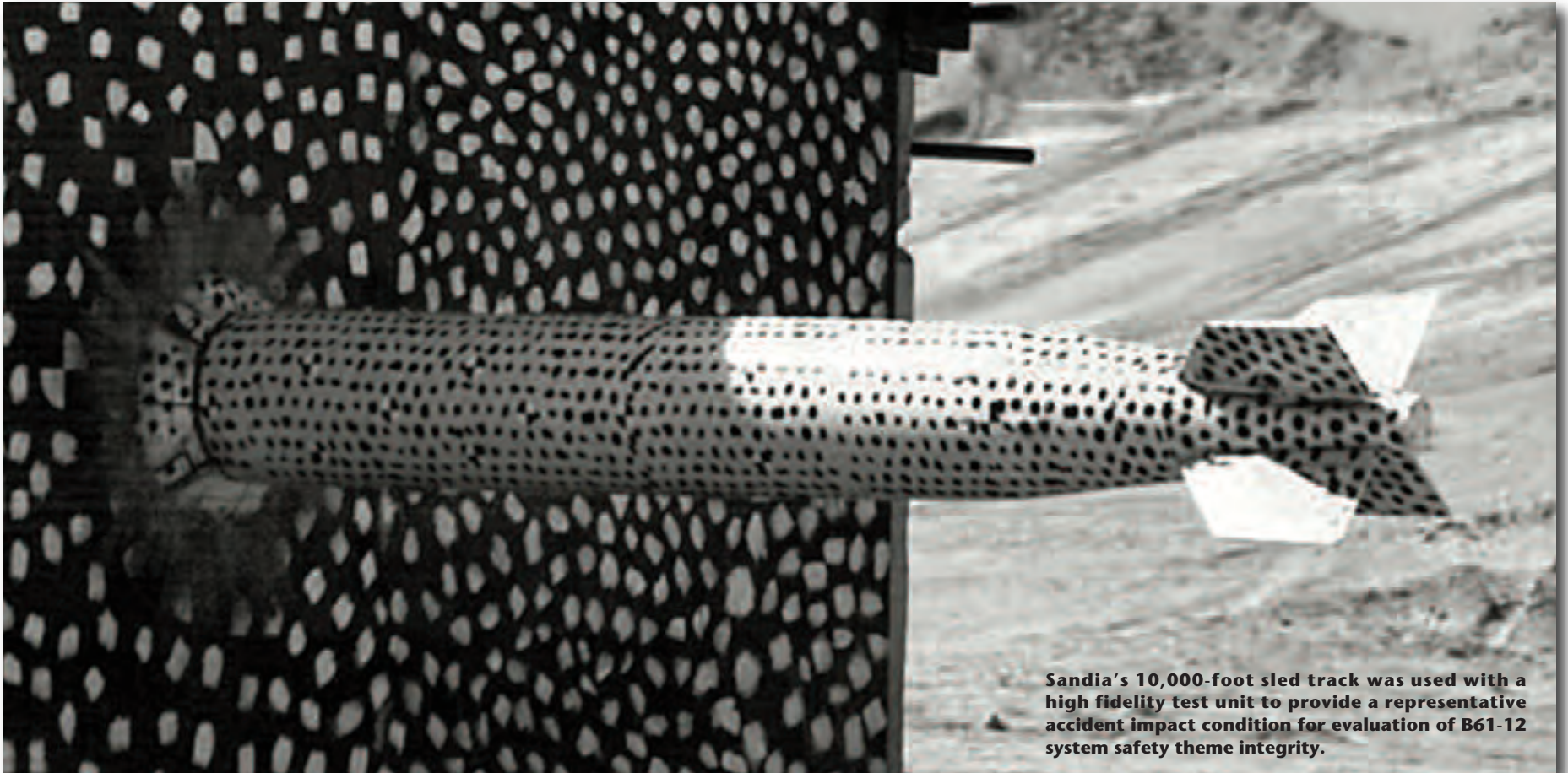
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## Nuclear weapons engineering



**Sandia's 10,000-foot sled track was used with a high fidelity test unit to provide a representative accident impact condition for evaluation of B61-12 system safety theme integrity.**

The B61-12 Life Extension Program successfully executed the Impact1 qualification test to evaluate the ability of the system safety theme to maintain a safe weapon configuration in a limiting accident scenario. The test occurred at Sandia's rocket sled track facility using a high-fidelity B61-12 configuration coupled with full-system,

solid-mechanics modeling to evaluate multiple aspects of the system safety theme. The event successfully captured weapon response data and demonstrated effective safety theme performance using representative hazards to properly simulate a weapon accident. (400, 1000, 2000, 4000)

**Sandia is leading the execution of Nuclear Enterprise Assurance (NEA)** requirements across the Nuclear Security Enterprise through leadership of the NEA Integration Working Group, which addresses implementation interfaces across all labs and plants. NEA protects the modernization programs and the enduring stockpile during the entire life cycle from potential denial of use risks through Weapon Trust Assurance and Supply Chain Risk Management. A robust R&D pipeline supports technology development. Partnerships with Mission Support organizations including logistics, purchasing, information management, and cybersecurity are critical to Sandia's success. (500)

The B61-12 Life Extension Program was authorized for transition into Phase 6.4, Production Engineering. This authorization is the culmination of multiple successful key deliverables demonstrating baseline weapon design performance, including the System Baseline Design Reviews, several dozen subassembly and Component Baseline Design Reviews, three development flight tests, more than 40 system and subsystem ground tests, publication of a Preliminary Weapon Development Report, and positive feedback from the Preliminary Design Review and Acceptance Group. (200, 400, 1000, 2000, 3000, 5000, 8000, 10000)

An integrated team developed a new methodology of risk-informed, system-specific surveillance objectives for prioritization of Sandia's nuclear weapon stockpile assessment work. Requirements were documented in system-specific Integrated Stockpile Evaluation Plans (ISEPs). The

The System Interface Tester (SIFTer) is an innovative software-based Nuclear Weapon testing solution for the Code Management System and has expanded capability to provide critical support for the B61-12 LEP. SIFTer emulates 24 unique hardware and software products of the use control system to support the B61-12 and CMS teams. SIFTer is used during engineering development and qualification to verify critical interfaces and internal functionality. The B61-12 and CMS programs rely on SIFTer in environmental testing as well as aircraft ground and flight tests. (2200, 6900)



Testing engineer Dave Clements uses SIFTer to prepare for a B61-12 flight test. (SIFTer connected to B61-12 test body)

objective of this effort is to detect defects and develop the capability to forecast potential technical risks that could impact safety, security, and/or reliability of the stockpile. This new approach will drive efficient use of resources while providing earlier indication of stockpile concerns. The initial implementation of this effort culminated in this year's

annual assessment presented to the Laboratories director. (400, 1800, 2200, 2900, 8200)

In meeting Sandia's commitment to ensure adequacy of nuclear safety design throughout the product realization process, the Independent Assessment team completed an assessment of the B61-12 LEP and W88 ALT Weapon Project Teams' Baseline Designs. Follow-on management reviews of both the Nuclear Safety design and assessment results were conducted with the chief engineer of nuclear weapons and the executive VP of National Security Programs, resulting in jointly signed memorandums to the Labs director documenting the adequacy of both systems' nuclear weapon safety baseline designs. (400)

Eight surety mechanisms under development for the B61-12 LEP and W88 ALT 370 have completed their last development build and are now moving forward into production process prove-in. All are designed to protect the system during an accident or unintended event. These components are sophisticated, custom-designed devices encompassing more than 700 unique parts and assemblies. Group 2610 has design responsibility with invaluable support from Science & Technology, Surety Engineering and Analysis, Stockpile Resource, Business Management and others. (1500, 1800, 400, 2900, 1300, 10600)



One of Sandia's most high-profile responsibilities to the nation by law is to annually assess the safety, reliability, and performance of the nation's nuclear stockpile and report the results through our customers to the president of the United States. This year's successfully executed approach incorporated significant improvements in the processes, content, and clarity of messaging to ensure critical facts and issues were communicated, while engaging all key organizations including weapon systems, components, surveillance, science, and others to inform the relevant national reviews and the Labs director's letter.

Sandia President and Laboratories Director Jill Hruby signs the Annual Assessment Letter.



## Nuclear weapons engineering

**The Final Design Review at the SP1115 level** for the W87 Alt 360 Gas Transfer System (GTS) Product Realization Team was successfully completed Aug. 23-25, 2016. The design review panel included five members from Sandia and one member from Kansas City National Security Campus. The Alt 360 PRT was applauded for the quality of the review, the great job managing the project, and the teaming among Sandia, Kansas City National Security Campus, and Savannah River National Laboratory/Savannah River Site. On schedule to deliver the First Production Unit in October 2018. (8200)

**The New Capabilities for Hostile Environments Grand Challenge** Laboratory Directed Research and Development (LDRD) project developed new X-ray and neutron test platforms with enhanced capabilities for NW-relevant radiation effects science testing. The platforms opened new avenues for survivability testing and enabled the exposure of NW-relevant devices to higher neutron fluences and higher photon energies and fluences than ever before. The platforms were designed to ensure survival of the test devices and to be coupled with advanced diagnostics that provide a high fidelity characterization of the temporal, spatial, and energy-dependent radiation environment. (1000, 2000, 4000, 5000, 6000, 8000)

**In a multi-laboratory collaboration**, experiments at HERMES III provided insight into gamma ray-driven air breakdown, photoemission, and electrical coupling, and thereby validated source-region electromagnetic pulse code predictions and validated the generation and propagation of prompt signals of interest for a variety of missions (Teller light, gamma rays, and electromagnetic pulse). More than 30 shots were conducted in the most heavily diagnosed experimental series ever recorded on HERMES III. The team received an NNSA Defense Programs Award of Excellence. (1300)



Sandia replaced the Entry Control Gate and installed new taxiway gates to improve operations and security at a NATO site.

**Sandia was tasked to design and implement** active vehicle barriers at a NATO facility. The barriers were installed at the Entry Control Point and at two aircraft taxiway gates. Sandia completed the barriers in January 2016. The system underwent Government Acceptance Testing (GAT) in March 2016. After the GAT was completed and accepted, the system was turned over to the Air Force, resulting in improved security to US overseas assets. (6500)

**Sandia's Aircraft Compatibility team** successfully completed multiple aircraft tests to prove the B61-12 LEP's application-specific integrated circuit (ASIC) product design. The rigorous test scheme included waveform capture, laboratory testing, ground testing, and captive-carry flight testing on all required aircraft. The team's efforts yielded vital performance information prior to a "freeze" of the B61-12's ASIC hardware. This critical risk reduction effort preserved B61-12 program resources by aggressively validating ASIC design and proper function within the weapon system. (2100, 2900)



Aircraft is loaded with B61-12 Compatibility Test Units prior to ASIC risk-reduction captive-carry flight testing at Eglin Air Force Base, Florida, in June 2016.



(Photo by Randy Montoya)

**In FY16, the Primary Standards Laboratory** performed calibrations on more than 13,000 individual pieces of test equipment for Sandia line organizations and more than 1,500 primary standards for the Nuclear Security Enterprise. This equipment is used for traceability of more than 75,000 measuring instruments across the complex. The

quantities represent an increase of 40 percent, supporting all aspects of Nuclear Weapons modernization, research, development, and Strategic Partnership projects. In addition to meeting the increased workload, the PSL reduced turnaround time for customers and provided critical measurement engineering support. (2500)



The first image shows the TTR Test Operations Center near completion. The next frame is a test asset in flight, milliseconds before impact. The final frame is a graphic of the fiber being trenched in the route around the range.

Tonopah Test Range completed significant improvements supporting surveillance and development testing in FY16. The Test Operations Center was outfitted with new electrical, environmental, plumbing, and fire protection systems, as well as exterior corrosion control and painting. TTR executed eight surveillance and develop-

mental flight tests and developed new procedures for future operations. TTR also completed a joint fiber optic installation of 59.5 miles of high-speed fiber, connecting 40-plus locations over 280 square miles of ground space, enabling the integration of four newly acquired remote sensor systems. (1000, 2000, 4000, 5000, 8000)





# Homeland Security

Critical federal networks are under constant cyber attack from malicious actors looking to undermine our nation's security. Sandia's National Security Cyber Red Team's (NCRT) job is to assess vulnerabilities in key DHS systems responsible for the defense of government networks. To detect and mitigate vulnerabilities, NCRT has performed multiple cybersecurity assessments using a rigorous methodology that originated with Sandia's mission to ensure a safe and reliable nuclear stockpile. The NCRT methodology has been developed and refined through decades of experience on cyber and cyber-physical systems. (6600, 5600, 8900)



NCRT leverages a rigorous methodology that originated with the Lab's mission to ensure a safe and reliable nuclear stockpile.



(Photo by Randy Montoya)

The release of toxic materials in a subway could result in widespread contamination of the system. To counter this threat, Sandia has developed and tested a method for containment and neutralization of highly toxic materials. Charged sprays of a mild decontamination chemistry are introduced to the cloud of material,

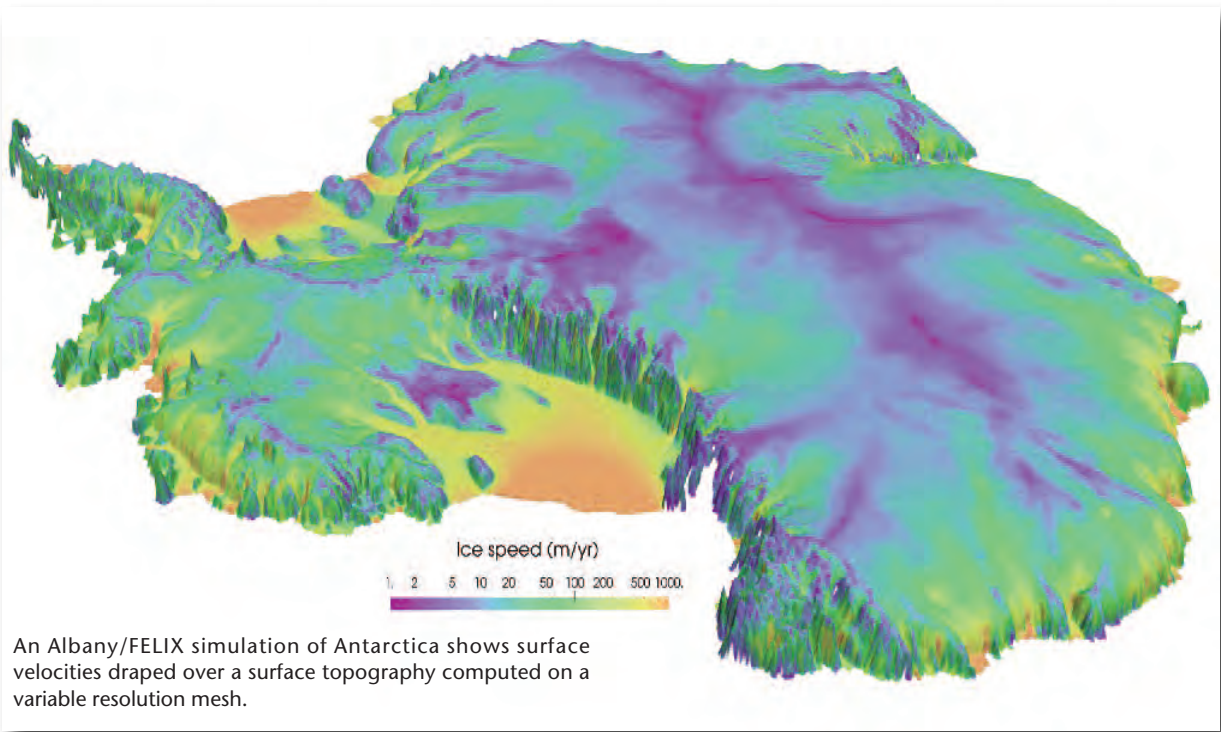


knocking it to the ground and neutralizing it. The approach has been demonstrated for biological pathogens, liquid aerosols of chemical materials, and vapors in a test chamber at Sandia and in a mock subway system (see above right) during a DHS demonstration. (6600, 6900)

# Climate

As part of the five-year multi-institution DOE/SciDAC [Scientific Discovery Through Advanced Computing] project PISCEES, Sandia has developed a land-ice simulation code that has been integrated into DOE's Accelerated Climate Model for Energy earth system model for use in climate projections. The Albany/FELIX code enables the calculation of initial conditions for land-ice simulations, critical for stable and accurate dynamic simulations of ice sheet evolution and the quantification of uncertainties in 21st century sea level rise. With NASA, the team has successfully validated simulations in comparison to actual Greenland ice sheet measurements. (8900,1400)

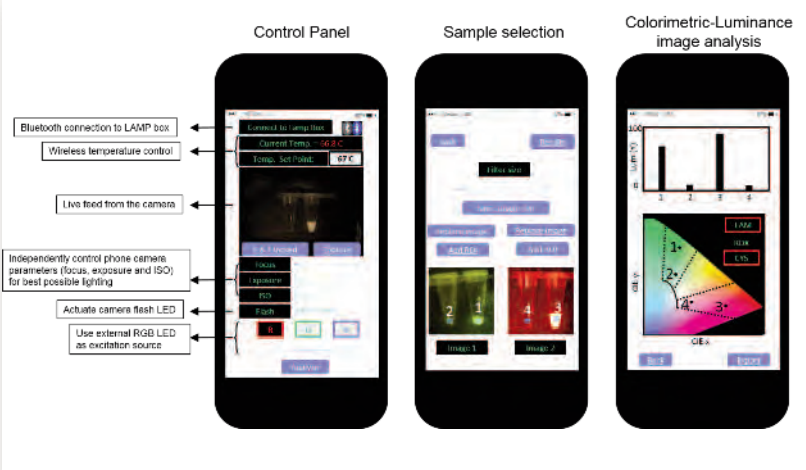
In 2016, Sandia researchers flew tethered balloons at DOE research facilities on the north coast of Alaska within Arctic clouds for 65 hours to more than 3,500 feet above the surface. Atmospheric measurements were collected as part of the Inaugural Campaigns for Atmospheric Radiation Monitoring Research using Unmanned Systems (ICARUS). A distributed temperature-sensing system and super-cooled liquid water sondes were operated for the first time in the Arctic during these balloon flights. Concurrent measurements from an unmanned aerial vehicle represent another first in the Arctic. (6900, 4100)



An Albany/FELIX simulation of Antarctica shows surface velocities draped over a surface topography computed on a variable resolution mesh.

# Bioscience

Our team has harnessed the versatility of generic smart-phones (camera sensors and Bluetooth) to detect genetic material of viruses such as Zika, chikungunya, and dengue. Our smartphone wirelessly actuates a low-powered heater to initiate the nucleic acid amplification and a novel onboard image analysis algorithm, dramatically enhancing the detection capabilities beyond traditional smartphone-enabled approaches. The technology enabled us to construct a light-weight (<1 pound), inexpensive (<\$50) and rapid detection (10-20 minutes) bioanalysis/diagnosis platform ideal for remote sensing in the field — even in low resource settings.



Screenshot of smart phone app for detection of pathogenic viruses shows assay control and analysis of assay endpoint using the phone's built-in camera and image processing capabilities. (8600)



## Global security



The Global Burst Detector (GBD) III Prime System Preliminary Design Review (PDR) was successfully completed in August 2016 with 100+ attendees representing diverse sectors of the US Nuclear Detonation Detection System community. The NNSA-led panel approved the system to fully

advance through the critical design phase (based upon fulfillment of the system-level PDR objectives and exit criteria) as the subsystems now prepare for their subsystem critical design reviews starting in June 2017. (5700, 5300, 2600, 10600) (Photo by Randy Montoya)



**Sandia's Fragment Tracking Diagnostic Development team** has begun a three-year study to investigate fragmentation device behavior, such as pipe bombs, and how to characterize case expansion, breakup, and fragment flight for development of Sandia's leading-edge numerical simulation capabilities. The project combines high-speed imaging, flash X-ray, computer modeling, laboratory measurements, and large-scale explosive tests to help researchers better understand explosively driven threats. Early results have generated significant interest from the applied physics and defense communities. This research has potential applications for DoD and DOE. (1500, 6600)

**Organic glass scintillators developed at Sandia** represent a new class of radiation detector materials. Scintillators emit light in the presence of radiation and are crucial to nonproliferation efforts. Organic glass scintillators bridge the gap between expensive, fragile, high-performance molecular crystals used in small detectors and inexpensive but less efficient polymers used in large detectors. Organic glass scintillators are easily melt-cast into shapes, are brighter than molecular crystal scintillators, and efficiently distinguish neutrons from gamma photons. (8100)

In January 2016, DOE and the Ministry of Foreign Affairs for the Kingdom of the Netherlands hosted Apex Gold, the first-ever ministerial-level gathering aimed at exploring national and international actions for addressing a nuclear crisis. Representatives from 37 countries participated in the event at Lawrence Livermore National Laboratory (LLNL). The event set important groundwork prior to the 2016 Nuclear Security Summit hosted by President Obama. Sandia collaborated with LLNL to demonstrate technical tools for detecting and analyzing nuclear material for the representatives. (8100)

**Sandia employed its systems engineering skills** to solve some of the most vexing challenges associated with the Ebola outbreak in West Africa. We used our expertise in international threat reduction, infectious diseases research, modeling, and systems analysis to improve the safety and security of laboratories handling live virus, help develop a basis for establishing a network of laboratories, reduce the time it took to analyze blood samples, and assist with post-outbreak draw-down and the secure elimination of diagnostic specimens. (6800, 6100, 8600)



An Ebola diagnostic laboratory is set up in Moyamba, Sierra Leone.

During FY16, Charles "Gus" Potter presented testimony to Congress and was named a Fellow of the prestigious Health Physics Society. In October 2015, Gus presented testimony on behalf of Sandia to the US House of Representatives Transportation and Infra-



(Photo by Randy Montoya)

CHARLES "GUS" POTTER

structure Committee's Subcommittee on Coast Guard and Maritime Transportation for a hearing on Prevention of and Response to the Arrival of a Dirty Bomb at a US Port. The hearing was focused on radiological scanning of incoming cargo containers, but Gus's testimony helped the subcommittee understand that this particular concern is just one component of a larger set of possible pathways from source to target. His briefing provided important information for consideration by the subcommittee as it sets policy for port security. During the 61st annual meeting of the Health Physics Society, held last July in Spokane, Washington, Gus was named a Fellow of the society. He is an internationally recognized expert on the measurement and impact assessment of radiation doses to humans. He was honored for his scientific, educational, and administrative contributions to the profession of health physics.

**Labs Director Jill Hruby joined DOE Secretary Ernest Moniz** and other leaders to commission the Chinese Center of Excellence for nuclear security. The center will provide training for security personnel in China's expanding nuclear power sector. DOE/NNSA and the China Atomic Energy Authority agreed to build the center in 2010. Sandia contributed equipment and expertise and consulted on the design, operation, and testing of a physical protection system at a mock material processing facility at the center. Sandia will also provide training for China's security professionals. (6800)

## Remote sensing

**The Advanced Remote Sensing Optical Field Deployment Team** deployed to six high-explosive test series that represent a varied cross section of explosive and weapon phenomenology. Such rich test article variety and data resources enable research into fundamental physical processes like detonation and combustion, as well as materials science and chemistry in extreme environments. Optical data is used to develop and validate simulation tools from device, coupled shock physics, fluid dynamics, chemical reactions and combustion, and optical radiation transport phases. (5700, 5400, 2500)

**Dan Wahl, a DMTS**, along with Dave Yocky, Charles Jakowatz, and Senior Scientist Katherine Simonson have developed a processing algorithm to improve the performance of coherent change detection (CCD) synthetic aperture radar. Their improved algorithm has been implemented by DoD. In addition, their technical paper, "A New Maximum-Likelihood Change Estimator for Two-Pass SAR Coherent Change Detection," was published in the *IEEE Transactions of Geoscience and Remote Sensing* in Volume No. 54 in April 2016. (5900, 5400)

**An advanced satellite ground system comprising command and control and data processing** for a set of advanced space-based sensors has been under development since FY13. This system, known as "Recap," is built on a modern software architecture and includes ~3.3 million source lines of code, modern operator interfaces, and will support national security needs. In September 2016, the project completed a 19-day customer-witnessed acceptance test of functional requirements. In November, the 27 racks and 36 pallets of hardware comprising the ground station were transported to the operational site. (2600, 5500, 9300, 9500, 10600)



## ES&H & security



The Mixed Waste Landfill Evapotranspirative Cover is shown during construction in 2009 after placement of the top soil layer.



This is a view to the west of the Mixed Waste Landfill engineered vegetative Evapotranspirative Cover with biointrusion barrier, June 2015.

After a 27-year effort and an approximate total cost of \$22 million, Sandia's Environmental Restoration Team achieved a landmark milestone with the closure of the Mixed Waste Landfill (MWL) and its full transition to Sandia's Long-Term Stewardship Program. From 1959 to 1988, the MWL had received low-level radioactive waste, hazardous waste,

and mixed waste. Closure efforts, which began in 1989, included investigations, monitoring, computer modeling, engineered barrier installation, and implementation of long-term safeguards. The New Mexico Environment Department Final Order for closure became effective in March 2016. (6100, 6200, 4100, 4200, 11100)

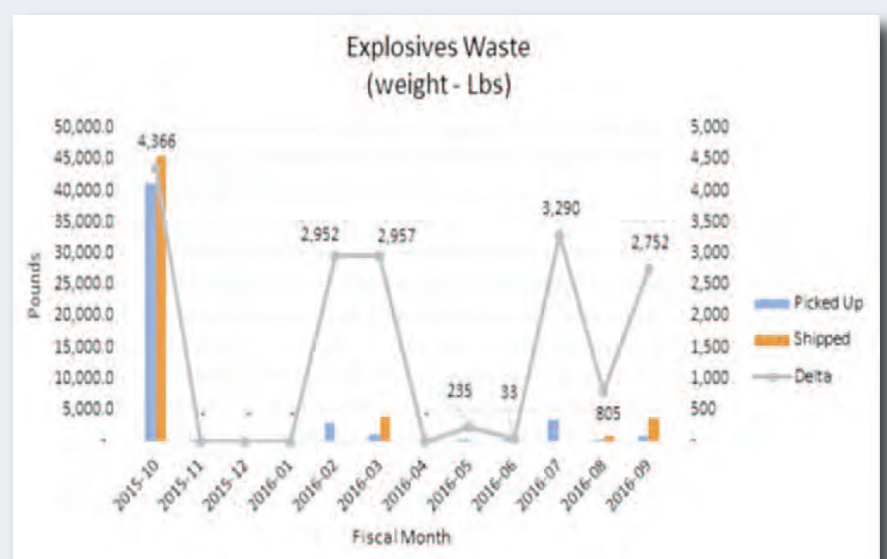
All buildings in New Mexico and California now have chemical containers tagged with Radio Frequency ID (more than 102,000 containers total) to ensure safer inventory reconciliation processes and increase accuracy of chemical inventory. (4100)

Emergency Management personnel successfully responded to a life-saving emergency. When the Emergency Management Communications Center received a 911 call related to an unresponsive person, the closest Protective Force personnel responded and immediately performed CPR. Emergency Response personnel then arrived on the scene to find the patient unconscious, unresponsive, and without a pulse. The Emergency Response Team took charge of scene management, airway management, compressions, and prepared the IV bag for the Sandia paramedics. The patient was then transported to Presbyterian Hospital for further treatment. (4200)

Team members from across Infrastructure Operations were fully integrated in the first of two supersonic reverse ballistic tests in support of the B61-12 nuclear weapons program. ES&H was engaged in all stages of testing, including planning, recovery, and ultimate disposition of test debris. Facilities assisted with site preparations and checking grounding systems. Emergency Management provided unified command during operations. The test was executed without incident and the site was remediated and restored in a safe condition for both the environment and personnel. (4100, 4200, 4800)

Security and Emergency Management (S&EM) achieved Quality New Mexico (QNM) Roadrunner Level 3 Status. The criterion for the award, based on the Baldrige Excellence Framework, is used worldwide to guide operations, improve performance, and achieve sustainable results. This accomplishment validates the commitment S&EM has made to process improvement and the incorporation of systemic quality principles into its activities. Additionally, obtaining QNM Roadrunner status plays a key role in the center's efforts toward achieving its Operational Excellence strategic objective. (4200)

Completing a four-year process, the final disposal of 8,300 legacy explosive Trackable Units was made in 2016. In 2011, Kirtland Air Force Base sought to eliminate explosive waste disposal on site. In response, a multi-function team assessed both classified and non-classified materials, streamlined the process, and created a disposal solution, all compliant with Department of Transportation requirements for off-site packaging and transportation. When all the final legacy waste items were properly disposed, it amounted to 32,000 pounds of explosive waste. (4100)



## Partnerships & alliances

The DOE-sponsored National Security Labs Day on Capitol Hill capped months of coordination to feature top scientists and engineers using hands-on displays to share with Congress how and why they do what they do. As part of the event, Sandia led a four-lab partnership to communicate that to date the B61-12 LEP is on schedule and budget, and how advanced engineering/science/computing capabilities enable stockpile stewardship, crossing over to benefit other missions including nuclear nonproliferation, homeland security, cyberspace, and national emergency response, all highlighted at the event. (160 and centers across the Labs)

Sandian Heather Kraemer answers questions about B61-12 and other display models in the Stockpile Stewardship booth during National Laboratories Day on Capitol Hill, a major NNSA tri-labs effort.





## Product realization



ELM/C&M/Production teams accept a new target loader at vendor, April 2016.

The highly motivated Equipment Lifecycle Management (ELM) team worked closely with its production and development partners to successfully deliver, install, and qualify 23 new pieces of equipment in FY16 to support complex processes such as evaporation and target loading, and highly specialized processes such as X-ray photoelectron spectroscopy. This equipment ensures needed availability and improved and updated functionality to the Neutron Generator Enterprise. (2700)

The Heterojunction Bipolar Transistor (HBT) Product Realization Team (PRT) delivered to the Kansas City National Security Campus the first compound semiconductor NW product from the MESA MicroFab. This delivery, two months ahead of schedule and on-budget, concludes several years of focused effort to transition this new technology into an NW-rigor production environment for current and future NW programs. Collocated design and production activities were key to meeting project milestones and laying the foundation for next-generation devices. (1700)

Sandia and Los Alamos National Laboratory completed the joint W88-0/Mk5 ALT 370 Preliminary Design Review and Acceptance Group (PDRAAG) review of the Preliminary Addendum to the W88 ALT 370 Final Weapon Development Report. This review was conducted by an independent DoD panel to evaluate the adequacy of the design meeting DoD customer requirements. Major milestones leading up to the PDRAAG included the System Baseline Design Review and the Inter-Laboratory Peer Review. The PDRAAG review is a prerequisite for Phase 6.4 Production Readiness authorization from NNSA. (200, 400, 1000, 2000, 5000)

Defect Prevention is a methodology applied throughout the product development lifecycle to identify, analyze, and prevent defects from re-occurring. Defect Prevention has been successfully implemented across nine projects, a new class has been deployed (NQT610 – Defect Prevention), and 25 new Quality Tool Cards have been released to aid users in implementation. The formalization of the Defect Prevention methodology throughout FY16 enables both Nuclear Weapons and Strategic Partnership Projects to launch their own initiatives for high-consequence programs seeking defect reduction and elimination. (400, 1500, 2000, 5000, 6000)

The Neutron Generator Enterprise (NGE) met or exceeded all deliverable commitments in the FY16 NGE Integrated Program Plan. This included a record number of NG builds (854) representing nine NG products in development and production. Other noteworthy FY16 highlights for the NGE were the realization of \$2 million in savings due to exceeding yield targets at various subassembly levels and the continued efficiency gains (doubled tooling capacity in the past two years) associated with the use of additive manufacturing to meet tooling needs. (2700, 400, 1500, 2100, 2500, 2800, 8200)

The Nuclear Weapons Summer Product Realization Institute (NW SPRINT) was officially recognized as a pipeline for prospective weaponeers. This institute was formed through a partnership of like-minded NW centers in an effort to define a compelling project-based experience for uncleared interns and new-hires. Three teams designed an environmental sensing device, built it with additive manufacturing techniques, and tested it on a centrifuge. The teams included 22 participants from 10 universities. NW SPRINT will now continue on an annual basis. (400, 2200, 2600, 2900)

Sandia developed a state-of-the-art Additive Manufacturing laboratory that supports rapid product realization by providing agile, adaptive, and responsive manufacturing of parts used for engineering evaluations, demonstrations, and communication of design intent. An engineer's digital model can now be directly manufactured on one of our laboratory's nine printers, which are capable of producing 5,000 cubic inches of products every month in polymer materials such as ABS, nylon, ULTEM™, polycarbonate, and photopolymer resins with tolerances of  $\pm 0.005$ " with greater than 95 percent accuracy. (2900)

The B61-12 Antenna Product Realization Team, consisting of team members from both Sandia and NNSA's Kansas City National Security Campus, achieved Qualification Evaluation Release (QER) status for the B61-12 JTA antenna in December 2015 after completing all requirements necessary to verify that the component is ready to release to production. This is the first B61-12 component to achieve QER. The Antenna PRT has achieved this significant milestone under budget and ahead of schedule. (5300)



B61-12 Joint Test Assembly Antenna Element

Sandia S-series actuator Production Agency (PA), partnering with Los Alamos National Laboratory Design Agency, instituted enhanced mistake-proofing controls and increased technical oversight of external supplier manufacturing processes in response to an anomaly discovered during actuator lot acceptance testing. Following process-improvement implementation across all S-series products, actuator performance dramatically improved as evidenced by early pathfinder lots. Resulting product delivery delays were subsequently compensated for through close collaboration among all affected weapon complex agencies including Sandia, Los Alamos, Kansas City National Security Campus, and Savannah River Site. (2500, 2900, 400, 10200, 10600)

## Materials

Sandia has streamlined a high-throughput tensile test method to rapidly evaluate the mechanical performance and reliability of structural materials. The method permits hundreds of tensile tests in the same time and for the same cost as ~5 conventional tensile tests, with no sacrifice in data fidelity. Engineers in Sandia's Materials Science and Engineering Center are using this new capability to assess variation in the mechanical performance of additively manufactured alloy components. The approach enables new materials or manufacturing processes that are agile, affordable, and assured. (1800)



A measurement camera looks on as a row of 50 tensile bars is tested automatically in rapid sequence. The resulting dataset is useful for engineering design, simulation, and reliability assessment.

By taking advantage of materials and phenomena from solid-state batteries, Sandia researchers have demonstrated a novel nonvolatile transistor based on Li-ion intercalation that has all the required attributes for an artificial synapse in a neuromorphic computer architecture: stable multi-level analog states, "write" linearity, low "write" noise, low switching voltage, and potential for scalability and low power dissipation. Simulations of backpropagation using the experimentally measured device properties achieve the highest classification accuracy with an energy cost per "write" operation of  $<10$  aJ for scaled devices. (8300, 1700)

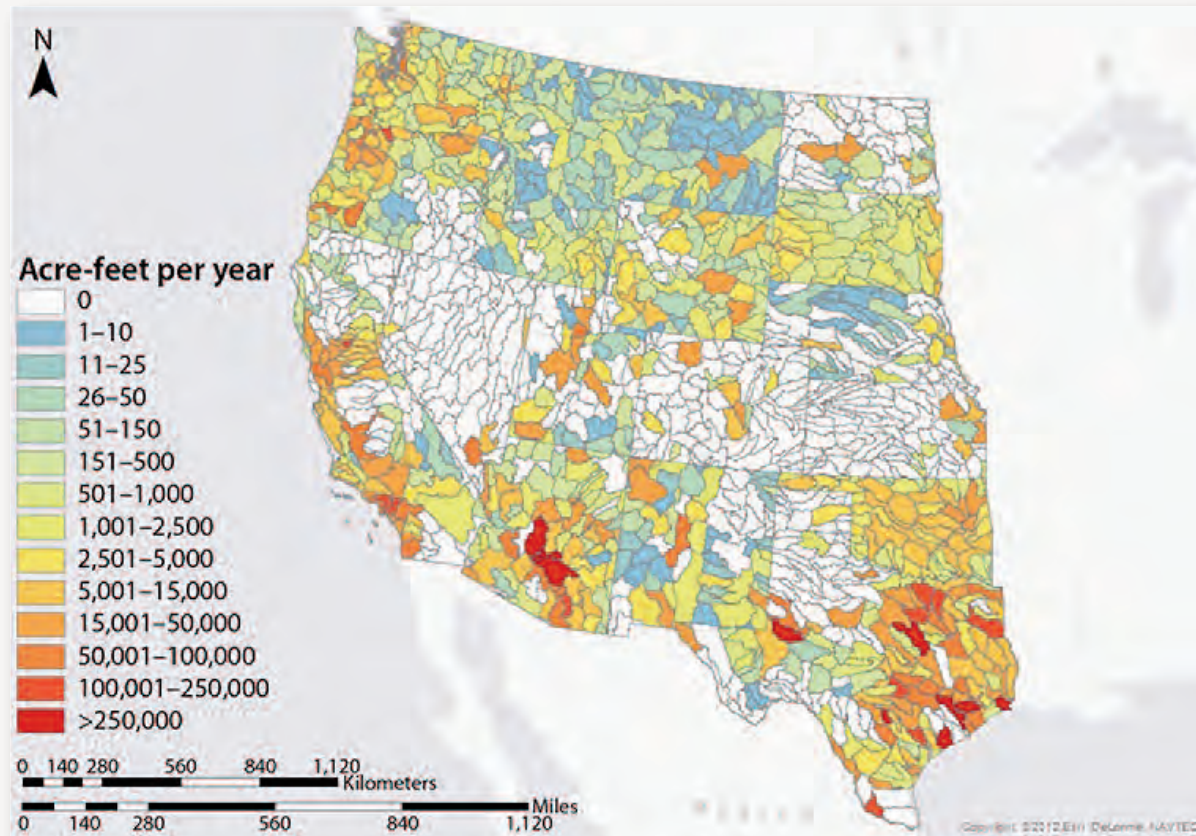
Universal qubits can be made using the electron spin of a donor atom in close proximity to an electron quantum dot. All previous successful efforts to make these devices relied on stochastic placement of donor atoms. Though these techniques worked, they had extremely low yield, preventing meaningful integration. Sandia scientists Mike Lilly et. al. have developed and demonstrated a new technique allowing for the precise control of donor placement during fabrication, increasing qubit yield and bringing quantum computers one step closer to reality. (1100, 1700)



## Computer & information sciences

**Sandia has conducted analyses of the economic impacts** and resource risks related to the depletion of the High Plains Aquifer, which extends under Nebraska, Kansas, Oklahoma, Texas, and New Mexico. A three-year study by the National Infrastructure Simulation and Analysis Center (NISAC) has led to con-

ference appearances and talks with officials in several states. Sandia presented at the Nebraska Infrastructure Protection Conference and held talks that were attended by the New Mexico state engineer, Oklahoma secretary of agriculture, and numerous stakeholders from Texas. (6900)



NISAC simulation shows how water demand will change by 2030.

(Photo source: <http://www.fastcodesign.com/3058542/the-scientists-who-simulate-the-end-of-the-world>)

**An ice sheet computational model** developed by the Center for Computing Research in collaboration with Los Alamos climate scientists has been selected to be part of the next-generation DOE climate model. Modeling the dynamics of Greenland and Antarctic ice sheets is critical to making sea level rise predictions, which potentially have large national security implications. The model features robust and scalable parallel solvers, inverse capabilities for estimating model parameters, tools for quantifying the uncertainty of the predictions, and has been used for science publications. (1400)

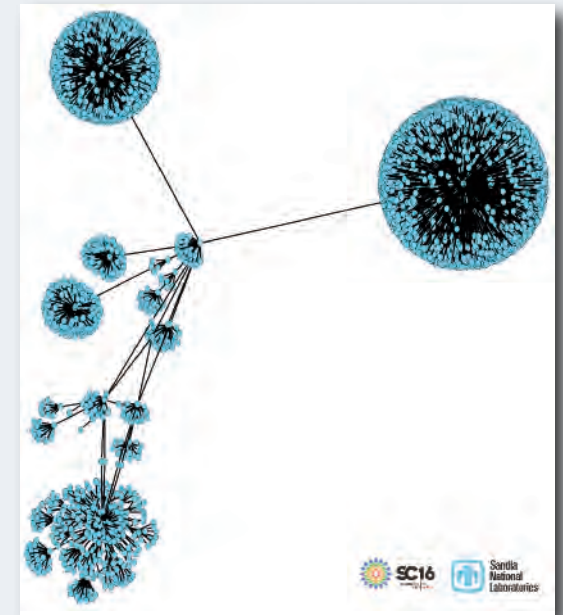
**Accurately quantifying hostile and reentry environments** for design of future stockpile systems without nuclear testing and with reduced numbers of flight tests requires new approaches to running simulations on next-generation supercomputers. Sandia has developed two new simulation codes for these environments that have successfully demonstrated that sensitivity and uncertainty analysis can be directly embedded within the codes along with performance portability abstractions that allow the

same code to run on widely different computer architectures (Intel Phi and NVidia GPU). (1300, 1400, 1500)

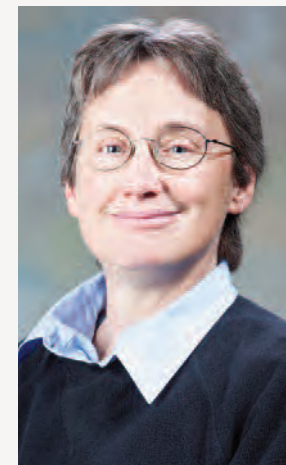
**During a special Odyssey program review**, the technical director of Sandia's United States government partner presented a meritorious achievement award to three project teams — Driftwood, TwoIota, and Hearthstone. The awards recognized tremendous teamwork, technical accomplishments, and deliveries of technologies being used actively by the customer and are impacting national security. When asked, "Why do you come to Sandia?" the immediate reply was "The people are amazing!" These projects leverage Sandia's cyber capabilities. (5600)

**Tamizar is a Sandia-developed software** that identifies malicious network traffic. Because it focuses on anomalous behaviors it can detect novel, sophisticated attacks that would bypass signature-based technology. Tamizar has been adopted by four government organizations and was recently used with great success at two live cyber training exercises. (5600)

**Sandia has developed a method of network and host discovery** to automatically create high-fidelity emulation models for assessing potential cyber threats. The tools, integrated with Sandia's Emulytics™ platform, can ingest real network sensor data and output a detailed description to create an emulated model of the network. These tools have been tested to model Sandia's network and, recently, the network of SC16 Supercomputing conference which during the conference is the largest open network in the world. (8900)



An automatically generated model of the SC16 Supercomputing conference's SCinet network uses live data with Sandia's minimega toolset. The modeled network consisted of more than 12k hosts and had a peak bandwidth near 1.2Tbit.



CINDY PHILLIPS

**Cindy Phillips** was selected as a Fellow of the Society for Industrial and Applied Mathematics for contributions to the theory and applications of combinatorial optimization. Cindy's wide-ranging work has had impact at Sandia on cybersecurity, parallel computing, infrastructure resilience, resource scheduling, and more. She has also played numerous leadership roles in her professional communities.



Researchers from Sandia, University of California, Davis, and Purdue University have developed Pyomo, extensible software for optimization-based analytics to support complex decision-making in real-world applications. Pyomo has been used to design sensor networks to protect water distribution systems, schedule

DoD satellite sensors, schedule production of NW components, design cyber defense strategies, plan NNSA operations for nuclear weapon life extension programs, and control power grid operations. Pyomo v4.1 was selected as one of the winners of the 2016 R&D100 Awards. (1900)

**The Skypunch Team** pressed the leading edge of cloud computing to bring new, differentiated research capabilities to Sandia. This team focused on establishing an R&D cloud environment that incorporates capability stewardship, mission integration program management, information assurance, cybersecurity, and emergent technologies. These goals were accomplished through integrating open source technologies to develop a common cloud computing framework and designing a multilevel system of R&D cloud environments. (5500, 5600, 9300, 1400)

**EMPIRE, an electromagnetic and plasma physics application** designed for performance assessment of nuclear weapons in electromagnetic and ionizing radiation environments, was enhanced for execution on next-generation platforms including Nvidia's Tesla graphics processing unit and Intel's Knights Landing processors. On-node performance on the early Trinity chips shows a factor of 43 speed-up going from one to 64 physical cores and effective use of hyper threads in the matrix assembly. Thus, the EMPIRE application demonstrated scaling on both current and next-generation applications superior to traditional message-passing interfaces. (1300)



## Military programs

**Under funding from US Special Operations Command** and special operations forces of Canada, UK, and Australia, Sandia developed and delivered operational prototypes of an inexpensive portable wind sense system to improve the shooting accuracy of special operations snipers. The system was evaluated by



Sandia Sniper Wind Sense prototype (left photo) with laser rangefinder mounted on top, and a Candian military sniper (right photo) using the prototype at a firing range.

multinational snipers with various winds, distances, and terrains, greatly improving first-shot hit probability, including at night when traditional wind estimation methods do not work. The testing success was significant enough that it was briefed to the Secretary of Defense. (5300)



**Sandia's Production Cryptographic Facility (PCF)** has generated more than 80,000 encrypted SNSI data packages for government contractor Cryptographic Installation Capabilities (CICs). The PCF and CICs provide military Global Positioning System (GPS) receiver vendors with a mechanism to program units at their own facility, eliminating logistical delays and headaches seen in the past when all receivers were programmed at a central government location. Sandia is expanding the scope of this effort to generate data packages for the next generation of Military GPS User Equipment (MGUE) vendors. (2600)

**Five Sandia researchers were part of a team** that received the 2016 Secretary of the Navy Innovation Catalyst Award and the Naval Sea Systems Command Warfare Centers' Transformation Award. The team included Lon Dawson, Phil Turner, and Mitch McCrory from Center 6200 and John Mulder and Alex Roesler from Center 5600. These awards were given in recognition of the team's significant contributions to deliver a cutting-edge capability to the Navy, eradicating a significant cyber threat by collaborating across disparate technology and organizational boundaries. (6200, 5600)



IREENA ERTEZA

**Ireena Erteza** has been named a 2017 Asian American Engineer of the Year. Ireena has made contributions in the areas of integrated and diffractive optics and information systems, radiation effects on optical processing systems, unattended ground sensor (seismic and acoustic) signal processing and algorithm development, synthetic aperture radar signal processing and

algorithm development, and high-performance computing. The Asian American Engineer of the Year Award is an annual award bestowed during National Engineers Week. It is the only national award program to pay tribute to Asian American engineers, scientists, and corporate leaders each year. The 2017 AAEOY award celebration marks the 16th anniversary of the organization. This award recognizes and celebrates outstanding Asian Americans who change the world through invention, innovation, and outstanding contributions to their companies, communities, and the nation. Past honorees include Nobel laureates and top industrial, academic and government leaders.

## IT, networks, & facilities

**The Analytics for Sandia Knowledge (ASK)** suite of tools was delivered and put into full production in FY16. ASK enables the enterprise to leverage corporate data in new and innovative ways. The suite of capabilities includes the framework, toolsets, and access to a collection of 46 enterprise data sets, allowing Sandia management and data scientists to run custom reports and analytics against the data. In addition, a set of general-use analytics and visualizations has been made available to assist the enterprise. The suite of tools can be accessed by managers at ask.sandia.gov. (9500)

**ERPlus transformed the work experience** by successfully integrating the Expense Report and Event Tracker applications. Several system enhancements and policy changes for the user were implemented through ERPlus, including the creation of an expense report from a conference request, automatic expense report approvals (where no exceptions exist), per diem costs for meals and incidentals auto-populated based on destination, lodging costs verified using Federal Travel Regulations, and paperless receipt documentation for all expense reports, which will eliminate hundreds of boxes per year of Corporate Storage as users choose this option. (9500, 10500)

**One of five Sandia R&D 100 Award winners** announced in early FY16, the Lightweight Distributed Metric Service (LDMS), provides capabilities long sought by high-performance computing (HPC) center administrators. The high-fidelity data monitoring and gathering capability of LDMS helps improve utilization of HPC resources, identifies energy-saving opportunities in large capability-class computers, and helps predict impending failures of system components, thus avoiding unplanned outages on production computers. (9300)

**Microsoft Corp. benchmarked** Sandia's Cyber Security Incident Response capabilities by conducting a Persistent Adversary Detection Services (PADS) assessment on Sandia's unclassified environment. Overall observations from the PADS out-brief: minimal malware found — much less than comparable networks; no determined threat actors detected on the network; Sandia cyber staff were aware of nearly all detections prior to the engagement. Microsoft concluded that "Sandia's Cyber Security Program is exemplary; it is well-managed and technically exceptional." (9300)

**On Aug. 9, 2016, NNSA put into production** a redundant connection from the NNSA Secret Network (NSN) to the DoD SIPRNET network. Sites in the eastern US are being routed through HQ, and sites in the western US are being routed through Sandia, with automatic failover in the event one of the circuits fails. NNSA now has a highly reliable connection to the DoD SIPRNET. (9300)

**With the completion of Bldg. 911 renovations** and new building construction, the layout of the California site will be open to the east and closed to the west. This reconfiguration increases Limited Area space, enabling expanding national security work and more effective management of security risks. The alternative finance proposal for an additional building, Collaboration in Research Engineering and Advanced Technology and Education (CREATE), was submitted to NNSA ahead of schedule. The addition of CREATE in the Livermore Valley Open Campus will facilitate external partnerships and enhance our ability to attract and retain a high-caliber workforce.

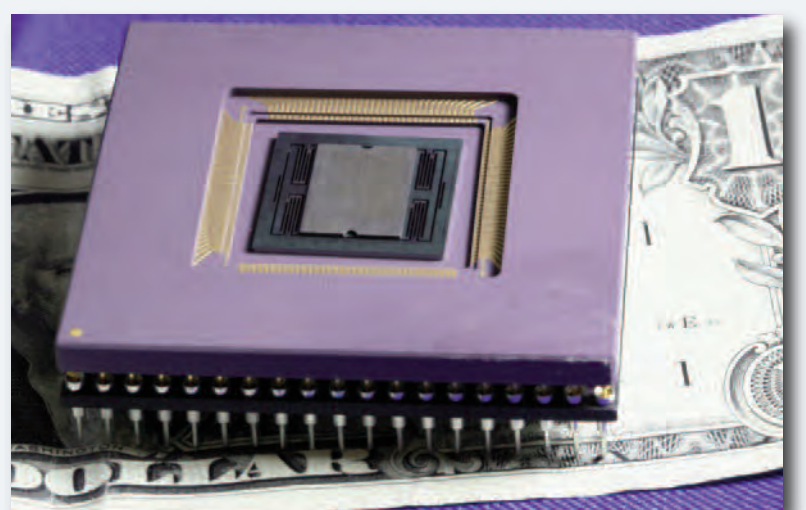


**Facilities Management and Operations Center (FMOC)** executed three key infrastructure projects funded by NA-50. In partnership with multiple centers within Division 2000 and Center 1200, FMOC coordinated and completed work on the Tonopah Test Range Control Tower, the Explosives Component Facility addition, and multiple refurbishment efforts for the Neutron Generator Production Facility. (4800)

## Microelectronics & microsystems

**Through the DARPA N-ZERO program,** Sandia demonstrated a wakeup sensor that consumes less power than a nightlight (6 nanowatts), beating the project goal by 40 percent. MESA-fabricated devices integrate MEMS and low-power CMOS into a sensor that draws almost no power until it detects an acoustic and/or vibration signature of interest. These technical breakthroughs aim to substantially extend the useful life of military sensors.

The MEMS component of Sandia's ultra-low power unattended vibration sensor.





## Engineering sciences

**Sandia's Multiphysics Modeling and Simulation** organization developed a capability to predict residual stress evolution through manufacturing processes and extreme plastic deformations. The new capability allows designers and analysts to visualize complex multiphysics processes and residual stress evolution in a way that was previously not possible. The developments have immediate impact and application areas that include assessing variability, improving manufacturing processes, helping with SFI investigations, and enabling future Gas Transfer System reservoir designs. (8200)

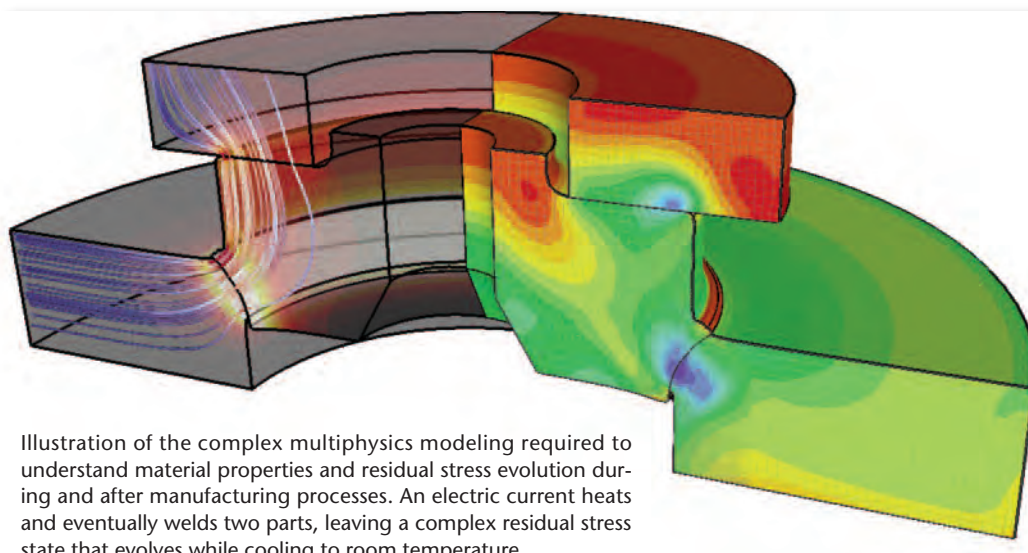
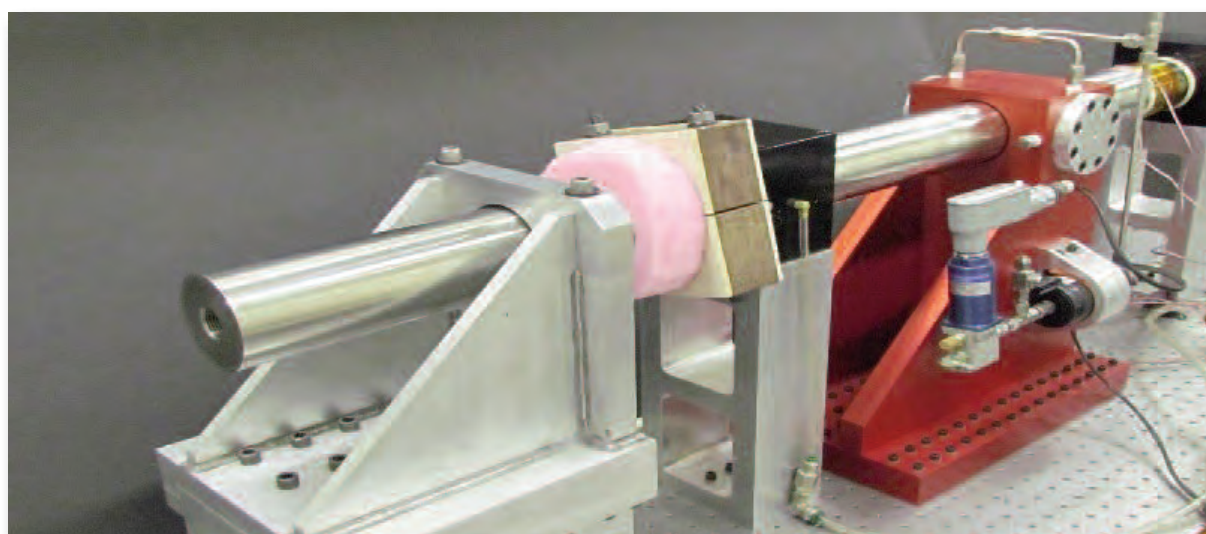


Illustration of the complex multiphysics modeling required to understand material properties and residual stress evolution during and after manufacturing processes. An electric current heats and eventually welds two parts, leaving a complex residual stress state that evolves while cooling to room temperature.

Enabled by cross-center teaming, a new launch accelerometer has been designed that is more tolerant to fabrication, assembly, and environment uncertainties. The development of a physics-based, nonlinear fluid and mechanical model empowered by uncertainty quantification has revealed behavior previously undetected by traditional deterministic analyses, quantified statistical performance of the existing design, and elucidated parameter variations that significantly impact performance. Ultimately, this has contributed to new launch accelerometer designs, specifications, and screening techniques to significantly improve margin despite uncertainties introduced through fabrication and assembly. (1500, 2600)

**Engineering Science and NW engineers** established a new test capability to provide extreme mechanical shock environments using a Hopkinson Bar in support of electronic neutron generator (ELNG) qualification tests for three nuclear weapon systems. The team successfully addressed the unique experimental challenge of demonstrating ELNG functional operation in sync with the arrival of the shock pulse. This mechanical shock capability is now accessible for other components and systems. These repeatable and controlled tests have reduced risk for the NW program and have the potential for future cost savings. (1500, 2700)



A newly developed 3-inch Hopkinson Bar in the Experimental Impact Mechanics lab provides extreme mechanical environments for materials, components, and structural testing and qualification.

## Pulsed power

**The New Capabilities for Hostile Environments on Z Grand Challenge** LDRD project developed the capability to safely use tritium in fusion targets on the Z facility for the first time. Experiments were conducted at trace tritium levels (0.1 percent), and established a future path toward 50-50 deuterium-tritium mixtures, with a potential increase in neutron yield of 60-90 times. This capability

will benefit multiple programs, including Inertial Confinement Fusion and Radiation Effects Sciences. The LDRD developed the capability for using in-situ discharge-cleaning electrode hardware to mitigate plasma formation and decrease current loss. (1300, 1600, 1800, 2100, 2700, 2900, 4100, 5400, 5900, 6200, 8200)

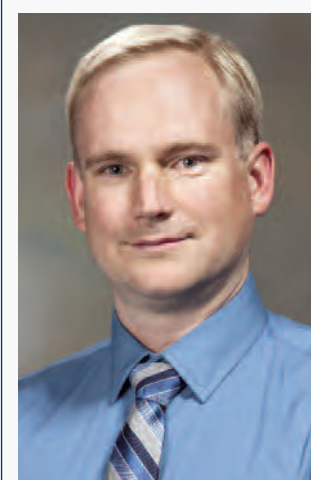
**The Z pulsed power facility** at Sandia executed a Pu experiment in collaboration with Los Alamos National Laboratory to support the B61-12 Life Extension Program certification. The B61-12 certification must determine if pit aging is a concern. The Z experiment provided fundamental data on four-year-old and 37-year-old B61 Pu from actual pits for certification modeling. (1600)

**We have demonstrated successful operation** of a proof-of-concept version of Thor, a pulsed-power accelerator with a revolutionary architecture optimized for megabar-class material-physics experiments. Thor will be powered by as many as 288 circuits, each of which generates — for 100 ns — a peak

electrical power of 5 GW. (The largest nuclear power plant in the US generates a steady-state power of 3.3 GW.) Thor creates pressure-loading time histories with unprecedented precision, and will position Sandia as the world's premier megabar-class material-physics laboratory. (1600)



Thor: a novel megabar-class material-physics accelerator. (Photo by Randy Montoya)



DEREK LAMPPA

Within the New Capabilities for Hostile Environments Grand Challenge LDRD project, **Derek Lamppa** led the Current Loss Reduction team that developed the in-situ plasma-cleaning process for Z machine convolute/diode hardware. The team demonstrated this process on surrogate diode assembly hardware, showing compatibility with diagnostics, and integrated the plasma-cleaning system onto the Z machine. The

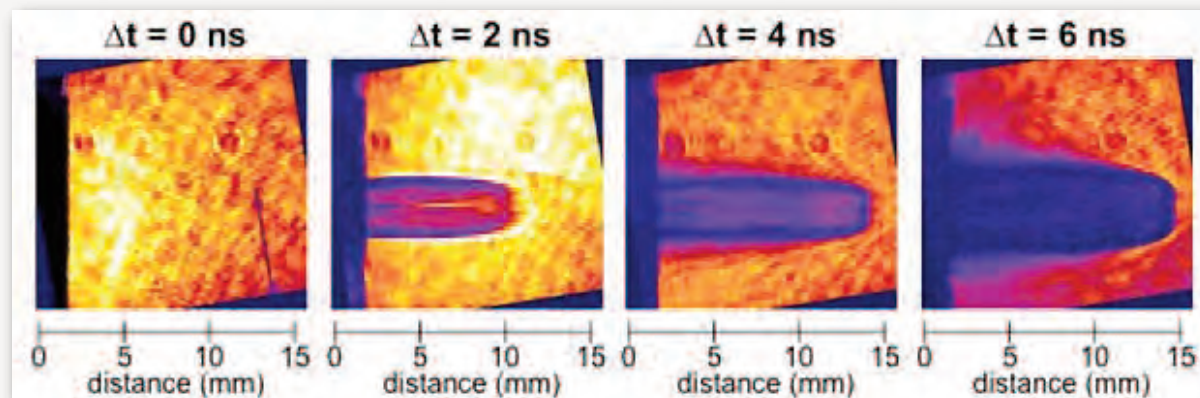
first-ever, in-situ cleaning was then demonstrated prior to a downline shot on a 20-MA accelerator. Derek also led development of diagnostics for current measurement and conductor temperatures that will be used to validate current loss models. Understanding loss mechanisms is critical for design of next-generation pulsed power machines beyond Z. Derek received the 2016 "Outstanding Young Engineer" award from the Albuquerque Section of the IEEE for engineering excellence and leadership in establishing the Systems Integration Test Facility and developing and testing novel systems that significantly impact all science programs on the Z Machine.



## Energy

The **Ultrafast X-ray Imager** is the world's fastest multi-frame solid-state camera (50 times faster) that can capture a sequence of images with user-selectable exposure times as short as 2 billionths of a second. Our camera was developed to enable scientists to study the heating

and compression of fusion targets in the quest to harness the energy process that powers the stars. These cameras are being used at Sandia's Z machine and at the National Ignition Facility at Lawrence Livermore National Laboratory. (1700, 1600)



Schlieren optical images of laser penetration and heating of a gas-filled target at Sandia National Laboratories

The development of sparingly solvating electrolytes for lithium-sulfur (Li-S) batteries surmounts a critical barrier to creating high energy density (400 Wh/kg(L)), low cost (\$100/kWh) transportation power sources. Transportation Storage team lead Kevin Zavadil, together with a team from DOE's Joint Center for Energy Storage Research (JCESR), have demonstrated how electrolytes in Li-S batteries can be engineered to reduce capacity loss and extend cycle life, providing a path to achieve DOE transportation storage goals for a new generation of battery technology beyond Li-ion. (1800)

**Ford Motor Company, Arbin Instruments, Sandia, and Montana Tech** recently completed the ARPA-E AMPED project to design, build, and validate a new high-precision, high-current battery tester for automotive and stationary applications. The tester significantly improves battery life predictions, helping meet the growing demand for better, longer-life electrified vehicle and grid storage batteries. Arbin intends to continue commercializing its high-precision technology, while Sandia and Ford will continue validation work, incorporating next-generation cells into future efforts. In November, the team received the 2016 R&D 100 Green Tech Special Recognition Award. (2500)

**Sandia surpassed its 30 percent** by 2015 energy intensity reduction goal with a 30.87 percent reduction at the end of September 2015 (relative to FY2003 energy intensity baseline) as reported in the FY2016 Site Sustainability Plan. This year, a new goal was set to 25 percent by 2025 with 2.5 percent reductions annually. Data shows that Sandia reached a 2.5 percent reduction for fiscal year 2016. (4800)

A **Sandia interdisciplinary team** was the first to report on the feasibility of using metal-organic frameworks as electrodes for Na-ion batteries. Limited energy resources require that innovative storage technologies be identified to provide adequate supply for future demand. The comprehensive study including materials synthesis and battery fabrication revealed a complex interplay between the structural characteristics of the materials and battery components and their cumulative effect on the overall performance. Their work was highlighted on the front cover of *Journal of Materials Chemistry A*. (2500, 1100)



Illustration shows the structural features of a metal-organic framework as featured on the cover of *Journal of Materials Chemistry A*.

**Sandia and the Electric Power Research Institute** held the first annual Secure Resilient Microgrid Systems Symposium in Baltimore in 2016. The event attracted about 100 participants from labs, industry, utilities, and government agencies. The symposium covered design and operational tools, methods, standards development, and research needs for secure and resilient microgrids in both civilian and military environments. Forum topics included grid integration and control issues when operating in grid-connected and islanded modes. Participants praised the symposium and expressed a strong desire for continuing the forum. (6100)



This rear facing instrument is used to measure the wind behind the turbine.

**Sandia's Wind Farm Technology Facility (SWiFT)** in Lubbock, Texas, recently restarted one of its advanced wind turbines as the final step in a rigorous DOE readiness review that returned SWiFT to full operational capability. Based on the approval, SWiFT performed the first-ever measurements of the wind behind the turbine (i.e., the wake) while also steering the wake to bypass a downwind turbine. Additionally, the SWiFT turbine controller and hardware in the loop system were leveraged by Vestas, the world's largest wind turbine manufacturer, for its quad-rotor technology demonstrator. (6100, 4100)



Sandia lead engineer Terry Johnson, left, and NREL engineer Chris Ainscough prepare the Hydrogen Station Equipment Performance (HyStEP) device for testing. (Photo by Dennis Schroeder/NREL)

The **Hydrogen Station Equipment Performance (HyStEP)** project won a regional Outstanding Partnership Award from the Federal Laboratory Consortium. Developed by Sandia and the National Renewable Energy Laboratory (NREL), the HyStEP device reduces the time to commission new hydrogen fueling stations from as much as months to just one week. HyStEP has been first deployed in California as the state is leading the nation with the most fuel cell electric vehicles on the road and plans to open 35 new retail hydrogen stations by the end of 2016. (8300, 8500)

**Scientists from Sandia and the University of New Mexico** collaborated to develop a revolutionary advance in carbon dioxide (CO<sub>2</sub>) capture technology. By confining water loaded with CO<sub>2</sub> enzymes in nanopores in ultra-thin membranes, the team created the Memzyme, which enables CO<sub>2</sub> capture from power plants, significantly reducing the threat from greenhouse gases. Applied to a single coal power plant, the annual CO<sub>2</sub> emissions avoided by the Memzyme would be equivalent to planting 63 million trees and letting them grow for 10 years. (8600, 1000)

**DOE's Supercritical Transformational Electric Power (STEP) program** seeks to facilitate commercialization of supercritical carbon dioxide (sCO<sub>2</sub>) technology. The Technology Roadmap details the current status of technology policy and market considerations, analyzes gaps and needs, and outlines the steps necessary for successful development and deployment of the STEP demonstration system by the end of FY19. This demo is the baseline focus that sets the foundations for the long-term goal of commercialization by 2025. (6200, 8600, 1900, 10600)



Sandia's supercritical CO<sub>2</sub> Brayton laboratory development platform. (Photo by Randy Montoya)



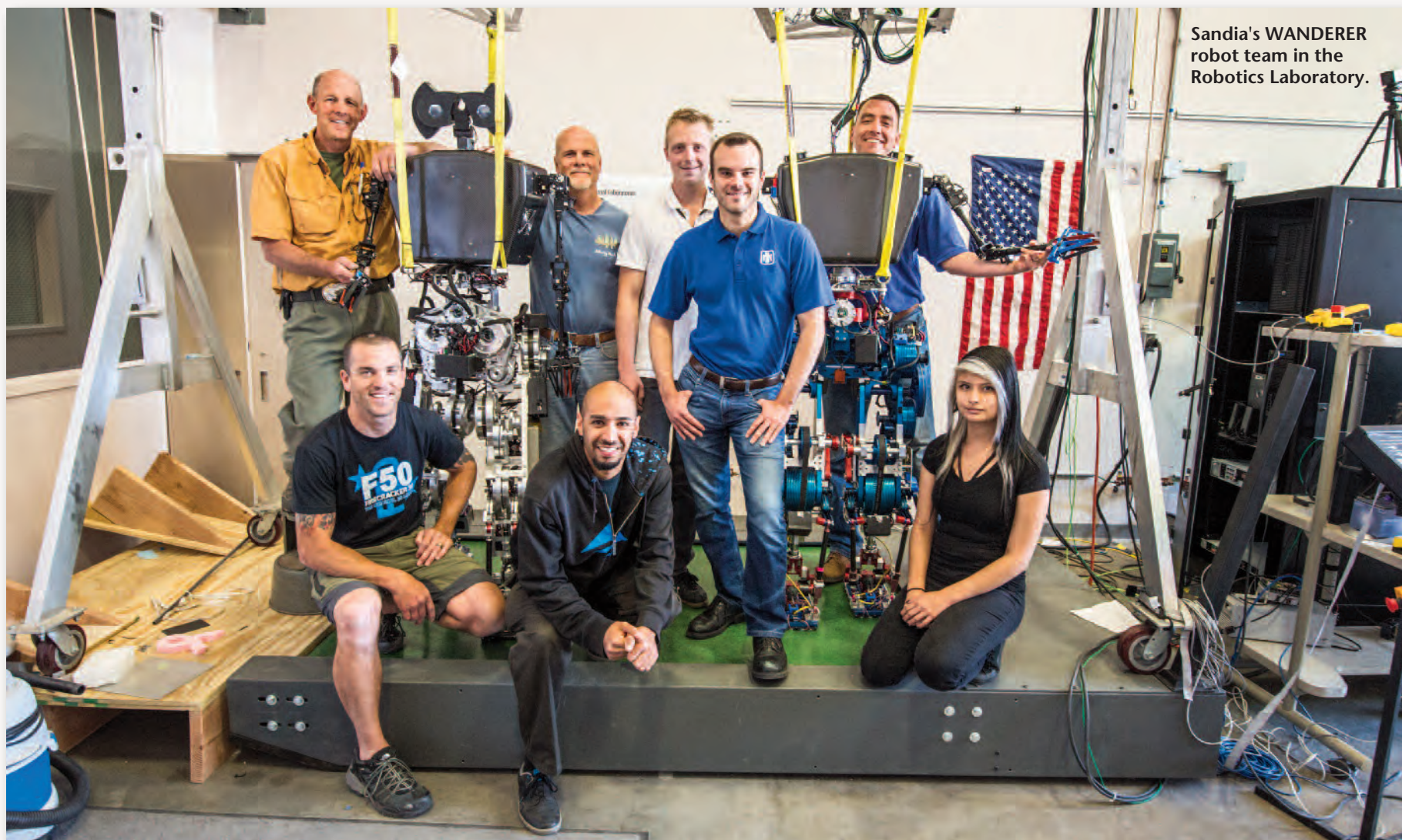
ROBERT KOLASINSKI

**Robert Kolasinski** has received a \$2.5 million, five-year Early Career Research Program award from DOE's Office of Science to support his work on how intense fusion plasmas interact with the interior surfaces of fusion reactors. Robert's research will develop the scientific foundations needed to determine how reactor surfaces change in a harsh plasma environment and to

identify mechanisms that limit material lifetime. His challenge will be to probe surface properties during plasma exposure without having to infer them from post-test analyses.



## Robotics



Sandia's WANDERER robot team in the Robotics Laboratory.

Sandia's Robotics team exhibited its bipedal walking robot, WANDERER, at the Technology Exposition portion of the DARPA Robotics Challenge Finals in Pomona, California. The team conducted a field test and demonstration. The Sandia-designed robot successfully operated for 5 hours and 20 minutes, including

4 hours and 9 minutes of active walking, traversing 2.8 km on a single battery charge. This level of performance exceeds that of previous walking robots by more than five times. Core components of the technology are readily transferable to other applications. (6500)

(Photo by Randy Montoya)

## HR, finance, & legal



HR and Communications VP Melonie Parker addresses attendees at the 2016 Employee Recognition Awards Celebration. (Photo by Lonnie Anderson)

In FY16 the Employee Recognition Awards (ERA) program was redesigned with three key principles in mind:

- To brand the ERA program with the focus on Sandia's culture of national security and mission success.
- To ensure all who have made outstanding contributions to Sandia's success are celebrated.
- To create an enjoyable and special celebration where

award recipients feel engaged and honored. As a result, for the first time ever, all winning individuals and team members were honored and celebrated in events held in Albuquerque and Livermore. A team with members from Executive Protocol, Creative Services, and HR/Total Rewards executed the events. (100, 3600, 3500)

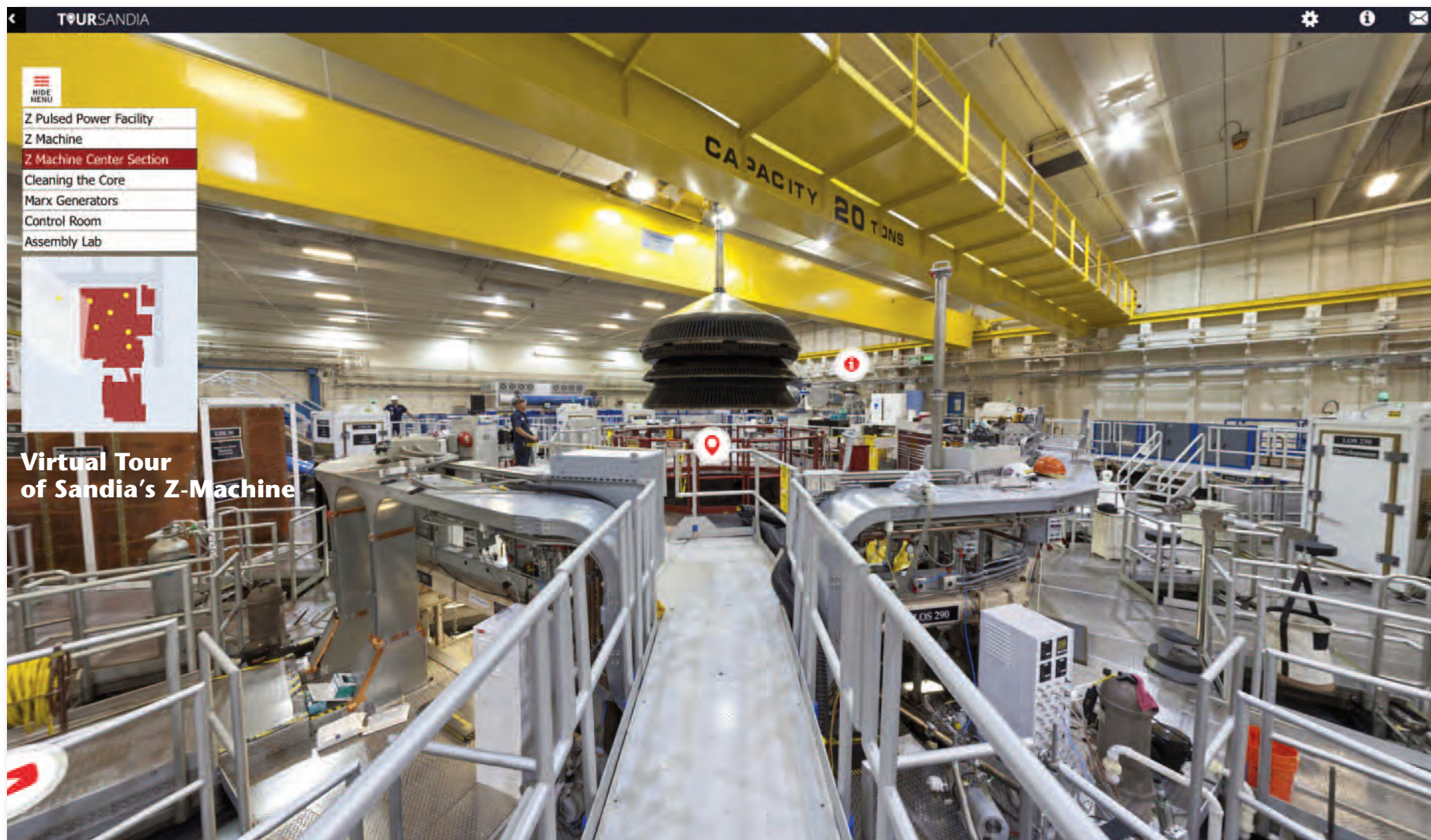


Sandia's Health Services Center obtained certification by NCQA (National Certification of Quality Assurance) as a Patient-Centered Connected Care facility. The program recognizes ambulatory care providers who communicate and connect with primary care providers as they deliver care to shared patients. To be recognized, Health Services demonstrated use of evidence-based guidelines for treating patients, coordination of care with primary care providers, improved outcomes and patient experiences through care coordination, improved trust among providers, and an impact on reducing healthcare waste. (3300)

The Project Lead Training pilot provided strong benefits such as knowledge sharing, reducing the number of overcommitted and over-costed projects, and developing integrated approaches for customer commitments. The pilot, implemented in February 2016, received such remarkable feedback that the training will officially roll out in FY17 rather than going through a second pilot. Centers will partner with DS&A Mission Assurance throughout course implementation. (5000, 10600, 10000)



## HR, finance, & legal



**Virtual Tour  
of Sandia's Z-Machine**

To motivate current talent development, attract intellectually curious recruits, and accelerate new employee orientation and engagement, Div. 3000 designed and developed Virtual Tours of Sandia's high-impact facilities (e.g.,

MESA, Z machine, CINT, and Sandia/California). These tours offer clear depictions in a visually stunning manner of the rich opportunities at Sandia and unique one-of-a-kind technical capabilities Sandia offers the nation. Those

tours, the result of a partnership between Centers 3600 and 3500 with mission technology input, are accessible on Sandia's external website and recruiting pages as well as internal webpages. (3500)

The NW Workforce Planning Team was instrumental in the development and use of a new tool/capability (TLE Tool) that is informing Sandia decision makers regarding future staffing gaps (surpluses or shortages) by year, center, and program as the NW modernization programs fluctuate. Through multiple interactive web-based scenarios, decision makers and planners can anticipate the expected and extreme possibilities that may occur over the next five to seven years. (100, 200, 8100, 9500)



Deb Menke presents an overview of Sandia's worksite health promotion and improvement programs at the 2016 Hero Forum in Atlanta. Sandia was recognized as an honorable mention for the C. Everett Koop National Health Awards.

Sandia received an honorable mention in the C. Everett Koop National Health Awards from the HERO foundation in recognition of outstanding worksite health promotion and improvement programs, including Sandia's onsite health clinics, the Health Action Plan program, the Virgin Pulse program, Energy Hubs, and more. The Koop Awards are the most prestigious awards for health improvement programs, requiring strong documentation of both health improvement and cost savings. Sandia was one of only two awardees for 2016. (3300)



National Labs Career Day was held Oct. 20 at the Atlanta University Consortium Center. Participating Historically Black Colleges and Universities included Spelman College, Morehouse College, and Clark Atlanta University. All 17 national laboratories attended, along with representatives from DOE, including the Honorable LaDoris "Dot" Harris, director of the Office of Economic Impact & Diversity, Dameone Ferguson from DOE's Diversity and Inclusion Program, and Annie Whatley, the DOE deputy director of Minority Education and Community Development. More than 60 STEM students attended panel discussions and a career fair. (3500)

To proactively facilitate and execute Cooperative Research and Development Agreements (CRADAs) in support of Sandia's technology transfer mission, a CRADA strategy was developed. Two new teams focused on economies of scale and provided the dynamics necessary to meet customer expectations. Efforts resulted in creating internal/external brochures and sample Statement of Work templates, significantly decreasing the amount of iteration on drafts. A Lean Six Sigma event reduced processing time by nearly 10 calendar days. All efforts were shared complex-wide and are collectively considered a best practice. (10500, 10000)

Sandia's due diligence around Environmental Liabilities has been noted as a NW complex best practice. By teaming

closely with technical Environmental Liabilities subject matter experts (SMEs) and technical/financial DOE/NNSA points of contact, Sandia accurately estimates and completely records all Environmental Liabilities while continuing to look for ways to improve the process. This best practice has been recognized for several years, and as a result, Sandia had input into the new complex-wide Active Facilities Data Collection System cost model. In FY 2016, Shelby Hansen, a Sandia SME, presented on the topic to the Contractor Financial Management Association conference in Washington, D.C. (10500)

Staff supporting the B61-12 LEP planned, created, conducted, and archived for future use NW complex-wide project controller training throughout FY16 and FY17. Attending project controllers, project managers, financial staff, and Product Realization Team leads were trained on the project management principles and skills required to implement sound Earned Value and project management principles. This gained expertise will benefit all current and future NW-related programs and projects. (10600)

In conjunction with material owners, the Corporate Storage Legacy Project has physically inspected and assessed more than 90 percent of the material in corporate storage.

This collaboration produced some exciting results:

- The corporate storage footprint was reduced by 12,479 cubic feet;
- More than 250 items were sent to the Nuclear Weapons Knowledge Preservation Program; and
- CRAY 1 and CRAY 2 supercomputers were located and saved. (10200, 10000)

Procurement and Facilities recently completed a strategic sourcing plan ensuring that Sandia construction projects are procured and executed as quickly and safely as possible. Through the recompetition, the Construction Partnership program team selected 17 construction partners, up from 10, to facilitate price competition to reduce customer costs and add more capacity to accommodate variable fiscal requirements. All partners are pre-qualified for safety, quality, and capability, and 15 partners are small businesses. (10200, 10000, 4000)



## Community involvement and public engagement

**My Brother's Keeper (MBK) Day at the Lab**, a White House initiative, provided inspiration and workplace exposure to 60 under-represented boys at Sandia/New Mexico. The boys were invited to participate in laboratory tours designed to connect students to potential careers and role models. Sandia/California participated in the Lawrence Livermore National Laboratory event. (3600, 1500, 1700, 6800)

MBK Day gives students access and visibility into what we do at Sandia and sparks student interest in pursuing a STEM career.

(Photo by Randy Montoya)



Sandia continued to increase awareness of the Labs' national security impact through its social media channels. In FY16, Sandia's social media won the APEX Grand Award for the second consecutive year and for the first time won two awards in a single year — excellence for overall social presence and distinction for online advertising and marketing — from the Academy of Interactive & Visual Arts. Sandia social media was highlighted multiple times as most engaged government content. Over the course of the year, Sandia saw an average 24 percent growth in audience. (3600)

The American Chemical Society awarded Sandia's CSI: DogNapping Workshop the 2015 ChemLuminary Award for Outstanding Kids & Chemistry at its national meeting in Boston. The workshop, developed by Tim Boyle and Bernadette Hernandez-Sanchez, reaches more than 400 New Mexico 4th-graders annually from economically challenged and under-represented minority schools and is designed to encourage interaction with scientists at their place of work. This prestigious outreach award is a first-of-a-kind for Sandia. The workshop is in its 12th year. (1800)

## Ethics and business conduct

The American Indian Science and Engineering Society (AISES) honored Marie Capitan as the inaugural recipient of the Blazing Flame Award at its national conference in Minneapolis, Minnesota, in November 2016.



MARIE CAPITAN

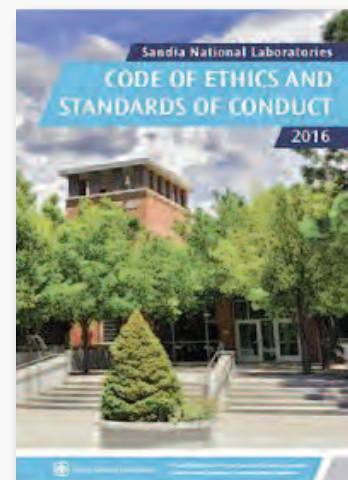
This award recognizes individuals with 10-plus years of professional experience with significant accomplishments in advancing STEM education and who also blaze a path for Native Americans in STEM careers. Sandia's support of national diversity awards directly aligns with its continued commitment to foster an inclusive work environment.

(Photo by Randy Montoya)

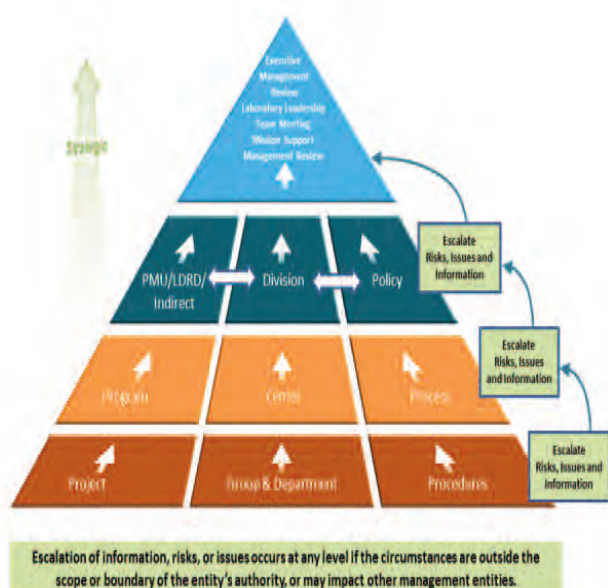
Sandia/California celebrated its 60th anniversary with two events. At the on-site workforce event in March, the current and six previous Div. 8000 VPs engaged in a lively history panel discussion. The second event was an open event in downtown Livermore. Attended by 500-plus people, the first-of-its-kind event included remarks by Labs Director Jill Hruby and Div. 8000 VP Marianne Walck, elected official commendations, national security speakers, science activities for children, and technology demonstrations by staff, high school students, and a Girl Scout troop. (8000)

Sparking interest in science, technology, engineering, and math (STEM) careers among young women was the focus of Sandia's first STEM Mentoring Café. The event included keynote remarks by LaDoris (Dot) Harris, director of DOE's Office of Economic Impact and Development, and Sandia President and Labs Director Jill Hruby, who shared their personal stories about their career paths. The girls explored several careers through hands-on activities and discussions with Sandia employees, including some of the challenges faced. More than 60 middle and high school girls participated. (3600)

An expanded Sandia *Code of Ethics and Standards of Conduct* was published. In addition to covering Sandia's Vision, Mission, and Values, the handbook helps employees understand expectations for maintaining personal and institutional integrity, including responsibilities of being an employee of a Federally Funded Research and Development Center. This collaborative effort, led by Ethics, included contributions from Legal, Human Resources & Communications, CFO & Business Operations, Security, Environmental Safety and Health, and the Executive Office. (800)



## Governance, leadership, & management



Sandia's Strategic Planning and Laboratories' Leadership department and Quality Assurance Excellence Group partnered to update the Laboratories' approach to Executive Management Review (EMR). The goal is to more explicitly focus on issues and risks with potential to impact the highest-priority commitments of the Labs' management entities. Since the re-designed EMR was implemented in FY16 Q1, it has elevated the executive dialogue and improved the leadership team's ability to identify and address systemic issues and risks. (100)

Sandia enhanced its approach to achieving high-quality results through an in-depth discussion of its mindful approach to achieving and sustaining operational excellence. Leveraging insights from organizations that achieved operational excellence, Sandia published the first addendum to *Performing Work at Sandia* that explains to the workforce how a questioning attitude, critical thinking, and the application of five key principles can result in operational excellence. (700)

Sandia strengthened Labs-wide awareness and understanding of quality-related principles through a three-year QMA that reviewed all divisions and program management units with regards to the 10 criteria specified in DOE Order 414.1.D, Quality Assurance. The QMA identified strengths and weaknesses to further continual improvement and emphasized application of the Plan-Do-Check-Act quality principles and defect prevention methodologies needed to enable consistent and predictable quality outcomes. (700)

A cross-functional team from Talent Management and Organizational Effectiveness, Strategic Planning and Laboratories' Leadership, and Executive Protocol redesigned and executed the National Security Leadership Development Program for the first time since 2010-2011. Twenty-seven senior managers and directors participated in the 10-month program designed to engage, develop, and inspire senior leaders to empower others to lead. The program used self-reflection and experiential learning to instill values-based leadership skills, develop relationships, and enable collaboration. (100)

Sandia achieved \$155.9 million in FY16 cost savings and cost avoidances, exceeding its efficiency goal of \$85 million. The cost savings were enabled by the launch of a new Operational Innovation application that is used to collect, analyze, and share data about innovative projects that are improving efficiency and driving down costs across the Labs. The application is available to all members of the workforce and to the Sandia Field Office. (700)

Gabrielle "Gabby" Holcomb, a quality assurance specialist, excels as the first woman in Sandia's Wounded Warrior Career Development Program. Gabby is a success. First, she succeeded as an Army civil affairs



GABRIELLE "GABBY" HOLCOMB

sergeant in the Iraq war and later she worked in a combat role out of Baghdad. Today she is a quality assurance specialist who received an Employee Recognition Award for her exceptional work in the counterfeit program. Sandia's Wounded Warrior Career Development Program specializes in hiring disabled combat veterans into positions at Sandia.





(Photo by Randy Montoya)